January 16, 2015

Mr. Gary Miller, Remedial Project Manager
U.S. Environmental Protection Agency, Region 6
Superfund Division (6SF-RA)
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

Re: San Jacinto River Waste Pits Superfund Site (CERCLA Docket No. 06-30-10)
         Follow up to December 16, 2014 Meeting Re: Relative Bioavailability Adjustment

Dear Mr. Miller:

During our meeting on December 16, 2014 to discuss the relative bioavailability adjustment
(RBA) factor for the San Jacinto River Waste Pits RI/FS, you requested details on several
technical issues. This letter provides those details, as follows:

- Source of data indicating that black carbon is present in the waste within the northern impoundments: Louchouarn and Brinkmeyer 2009. (Please see attached list of references.)
- Publications that address the effects of weathering of soils/sediments on the bioavailability of chemicals in soil: Goon et al. 1991; Magee et al. 1996; Poiger and Schlatter 1980; Saghir et al. 2007; Umbreit et al. 1986. (Please see attached list of references.)
- Tables showing re-calculation of PCLs with RBA = 1. (Please see Attachment 1.)

Please let us know if you have any additional questions.

Sincerely,

David C. Keith

David Keith, Ph.D., P.G.
Project Coordinator

REFERENCES

Goon, D., N.S. Hatoum, M.J. Klan, J.D. Jernigan, and R.G. Farmer, 1991. Oral Bioavailability of "Aged" Soil-Adsorbed Benzo(a)pyrene (BaP) in Rats. Toxicologist 11 (1991):1356.

Louchouarn, P., and R. Brinkmeyer, 2009. *Fate of Dioxin in the Houston Ship Channel and Evaluation of Natural Remediation Processes.* Prepared for Texas Commission on Environmental Quality, Total Maximum Daily Load Program, Austin, TX. Texas A&M University at Galveston, Galveston, TX.

Magee, B., P. Anderson, and D. Burmaster, 1996. Absorption Adjustment Factor (AAF) Distributions for Polycyclic Aromatic Hydrocarbons (PAHs). Human Ecol. Risk Assess. 2(4):841-873.

Poiger, H., and C. Schlatter, 1980. Influence of solvents and adsorbents on dermal and intestinal absorption of TCDD. Food Cosmet Toxicol 18:477-481.

Saghir, S.A., M.J. Bartels, R.A Budinsky, E.E. Harris, A.J. Clark, J.L. Stanley, Y. Chai, and J.W. Davis, 2007. Effect of Organic Carbon Content, Clay Type, and Aging on the Oral Bioavailability of Hexachlorobenzene in Rats. Env. Toxicol. Chem. 26(11):2420-2429.

Umbreit, T.H., E.J Hesse, and M.A. Gallo, 1986. Bioavailability of dioxin in soil from a 2,4,5-T manufacturing site. Science 232:497-499.

ATTACHMENT 1

Table 1
TEQ$_{DF}$ Soil PCL for Commercial Workers, Noncancer Endpoint

Parameter		Units	PCL with RBA=0.5	PCL with RBA=1
Target Risk Level &Toxicity Criteria				
Target Hazard Index	TH	unitless	1	1
Reference Dose	RfD	pg/kg-day	7E-01	7E-01
Common Parameters				
Exposure duration	ED	years	25	25
Exposure frequency	EF	days/year	225	225
Fraction of intake that is site-related	FI	% as fraction	1	1
Body weight	BW	kg	80	80
Averaging time - noncarcinogenic	AT$_{nc}$	days	9,125	9,125
Conversion Factor 1	CF$_1$	kg/mg	1E-06	1E-06
Conversion Factor 2	CF$_2$	pg/ng	1E+03	1E+03
Pathway Specific Parameters				
Incidental Ingestion of Soil				
Soil ingestion rate	IR$_s$	mg/day	100	100
Relative Bioavailability Adjustment factor	RBA	% as fraction	0.50	1.00
PCL for Soil Ingestion, noncancer	PCLsoil-nc-ing	ng/kg	1.8E+03	9.1E+02
Dermal Contact with Soil				
Dermal adherence factor	AF	mg/cm^2	0.2	0.2
Skin surface area exposed	SA	cm^2	3,470	3,470
Event frequency	EV	day^{-1}	1	1
Dermal absorption fraction	ABS$_d$	% as fraction	0.03	0.03
PCL for Dermal Contact, noncancer	PCLsoil-nc-dermal	ng/kg	4.4E+03	4.4E+03
Commercial Worker PCL - All Pathways (ng/kg)			**1,300**	**750**

Notes
   PCL = protective concentration level
   RBA = relative bioavailability adjustment

Equations:

$$PCL = \frac{1}{\frac{1}{PCL_{ing}} + \frac{1}{PCL_{dermal}}}$$

$$PCL_{ing}\left(\frac{ng}{kg}\right) = \frac{TH \times AT_{nc} \times BW}{ED \times EF \times FI \times IR_s \times RBA \times \frac{1}{RfD} \times CF_1 \times CF_2}$$

$$PCL_{dermal}\left(\frac{ng}{kg}\right) = \frac{TH \times AT_{nc} \times BW}{ED \times EF \times FI \times AF \times SA \times ABS_d \times \frac{1}{RfD} \times EV \times CF_1 \times CF_2}$$

Table 2
TEQ$_{DF}$ Sediment PCL for Child Recreational Visitors, Noncancer Endpoint

Parameter		Units	PCL with RBA=0.5	PCL with RBA=1
Target Risk Level &Toxicity Criteria				
Target Hazard Index	TH	unitless	1	1
Reference Dose	RfD	pg/kg-day	7E-01	7E-01
Common Parameters				
Exposure duration	ED	years	6	6
Exposure frequency	EF	days/year	104	104
Fraction of intake that is site-related	FI	% as fraction	1	1
Fraction of exposure from sediment	F_s	% as fraction	0.50	0.50
Body weight	BW	kg	19	19
Averaging time - noncarcinogenic	AT$_{nc}$	days	2,190	2,190
Conversion Factor 1	CF$_1$	kg/mg	1E-06	1E-06
Conversion Factor 2	CF$_2$	pg/ng	1E+03	1E+03
Pathway Specific Parameters				
Incidental Ingestion of Sediment				
Sediment ingestion rate	IR$_s$	mg/day	125	125
Relative bioavailability adjustment factor	RBA	% as fraction	0.50	1.00
PCL for Sediment Ingestion, noncancer	PCLsed-nc-ing	ng/kg	1.5E+03	7.5E+02
Dermal Contact with Sediment				
Dermal adherence factor	AF	mg/cm^2	3.6	3.6
Skin surface area exposed	SA	cm^2	3,280	3,280
Event frequency	EV	day^{-1}	1	1
Dermal absorption fraction	ABS$_d$	% as fraction	0.03	0.03
PCL for Dermal Contact, noncancer	PCLsed-nc-dermal	ng/kg	2.6E+02	2.6E+02
Recreational Visitor PCL - All Pathways (ng/kg)			**220**	**200**

Notes

PCL = protective concentration level

RBA = relative bioavailability adjustment

Equations:

$$PCL = \frac{1}{\frac{1}{PCL_{ing}} + \frac{1}{PCL_{dermal}}}$$

$$PCL_{ing}\left(ng/kg\right) = \frac{TH \times AT_{nc} \times BW}{ED \times EF \times FI \times F_s \times IR_s \times RBA \times \frac{1}{RfD} \times CF_1 \times CF_2}$$

$$PCL_{dermal}\left(ng/kg\right) = \frac{TH \times AT_{nc} \times BW}{ED \times EF \times FI \times F_s \times AF \times SA \times ABS_d \times \frac{1}{RfD} \times EV \times CF_1 \times CF_2}$$

Table 3
TEQ$_{DF}$ Soil PCL for Construction Workers, Noncancer Endpoint

Parameter		Units	PCL with RBA=0.5	PCL with RBA=1
Target Risk Level &Toxicity Criteria				
Target Hazard Index	TH	unitless	1	1
Reference Dose	RfD	pg/kg-day	7E-01	7E-01
Common Parameters				
Exposure duration	ED	years	1	1
Exposure frequency	EF	days/year	250	250
Fraction of intake that is site-related	FI	% as fraction	1	1
Body weight	BW	kg	80	80
Averaging time - noncarcinogenic	AT$_{nc}$	days	365	365
Conversion Factor 1	CF$_1$	kg/mg	1E-06	1E-06
Conversion Factor 2	CF$_2$	pg/ng	1E+03	1E+03
Pathway Specific Parameters				
Incidental Ingestion of Soil				
Soil ingestion rate	IR$_s$	mg/day	330	330
Relative bioavailability adjustment factor	RBA	% as fraction	0.50	1.00
PCL for Soil Ingestion, noncancer	PCLsoil-nc-ing	ng/kg	5.0E+02	2.5E+02
Dermal Contact with Soil				
Dermal adherence factor	AF	mg/cm^2	0.2	0.2
Skin surface area exposed	SA	cm^2	2,630	2,630
Event frequency	EV	day^{-1}	1	1
Dermal absorption fraction	ABS$_d$	% as fraction	0.03	0.03
PCL for Dermal Contact, noncancer	PCLsoil-nc-dermal	ng/kg	5.2E+03	5.2E+03
Construction Worker PCL - All Pathways (ng/kg)			**450**	**240**

Notes

PCL = protective concentration level

RBA = relative bioavailability adjustment

Equations:

$$PCL = \frac{1}{\frac{1}{PCL_{ing}} + \frac{1}{PCL_{dermal}}}$$

$$PCL_{ing}\left(\frac{ng}{kg}\right) = \frac{TH \times AT_{nc} \times BW}{ED \times EF \times FI \times IR_s \times RBA \times \frac{1}{RfD} \times CF_1 \times CF_2}$$

$$PCL_{dermal}\left(\frac{ng}{kg}\right) = \frac{TH \times AT_{nc} \times BW}{ED \times EF \times FI \times AF \times SA \times ABS_d \times \frac{1}{RfD} \times EV \times CF_1 \times CF_2}$$